What We Claim is:

1. A method comprising:

constructing a test comprising test items and selecting a set of attributes designed to measure proficiency of examinees taking the test and that each examinee has or has not achieved mastery thereof;

creating a mathematically expressed model comprising the test items and the selected attributes, the selected attributes being a subset of a larger group of attributes influencing examinee test item performance with an unspecified remainder of the larger group of attributes being accounted for in the model by a residual ability parameter, the model including parameters describing how the test items depend on the selected set of attributes and how the test items also depend on the residual ability parameter in such a manner that examinee responses to test items provide estimation information about each parameter permitting calibration thereof and provide predictions of which attributes the examinees have or have not achieved mastery thereof, the model further accounting for a probability that each examinee for each individual test item may achieve mastery of all the attributes from the subset of the selected set of attributes required for the individual test item but fail to apply at least one required and mastered attribute correctly to the individual test item thereby responding to the test item incorrectly and that each examinee for each individual test item may have failed to achieve mastery of at least one required specified attribute for the item and nevertheless apply each required specified attribute for which mastery was not achieved correctly to the item and also applying the remaining required and mastered attributes from the selected set of attributes correctly to the item thereby responding to the test item correctly, the model defining mastery of each attribute to be an assigned level representing that an examinee exceeding the level has acquired attribute competence thereof, and the model expressing for pairs of the set of selected attributes a positive association between the two members of each of the pairs and further expressing a size measure of the positive association of each pair of attributes that can be estimated for each pair from the examinee responses to individual test items; and

66

applying test results obtained from responses of the examinees to calibrate the individual test items of the model and to generate a prediction of attribute mastery, a prediction of failure to achieve mastery, or a withholding of any prediction for each individual examinee and individual specified attribute combination.

2. A method in accordance with Claim 1 comprising:

constructing a test comprising test items, $X_{ij}=0$ or 1 according as Examinee j gets Item i wrong or right respectively, and selecting a set of attributes $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Examinee j has failed to master or has mastered Attribute k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the test items depend on the selected set of attributes according to the following probability:

$$S_{ij}= (\pi_i{}^*) \times (r_{i1}{}^*)^{1-\alpha j1} \times (r_{i2}{}^*)^{1-\alpha j2} \times ...\times (r_{im}{}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of applying all the required attributes correctly as determined by examinee mastery and nonmastery of these required attributes, the product of r^*'s in S_{ij} over the m attributes required for Item i as specified by an item/attribute incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik}= r_{ik}/\pi_{ik}$, with $r_{ik} =$ Prob(Attribute k applied correctly to item i given that the examinee has not mastered Attribute k), $\pi_{ik} =$ Prob (Attribute k applied correctly to Item i given that the examinee has mastered Attribute k), expressing the size measure of the positive association of each pair of attributes indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal attribute precursors $\alpha'_k, \alpha'_{k'}$ to dichotomous attributes $\alpha_k, \alpha_{k'}$, the needed dichotomous attribute pairs $\alpha_k, \alpha_{k'}$ then produced by cutting each α'_k at a specified mastery level cutpoint such that the Attribute k mastery probability p_k that ($\alpha_k=1$) is defined to equal Prob($\alpha'_k \geq$ cut point) with the level of attribute mastery thus defined by selecting the cut point for α'_k with p_k being the user determined proportion of examinees judged to have mastered Attribute k, thereby each attribute through the continuous α'_k and its cut point having an assigned level representing that an examinee exceeding that level has acquired attribute mastery thereof.

3. A method comprising:

constructing a test comprising test items and selecting a set of attributes designed to measure proficiency of examinees taking the test and that each examinee has or has not achieved mastery thereof;

creating a mathematically expressed model comprising the test items and the selected attributes, the selected attributes being a subset of a larger group of attributes influencing examinee test item performance with an unspecified remainder of the larger group of attributes being accounted for in the model by a residual ability parameter, the model including parameters describing how the test items depend on the selected set of attributes and how the test items also depend on the residual ability parameter in such a manner that examinee responses to test items provide estimation information about each parameter permitting calibration thereof and provide predictions of which attributes the examinees have or have not achieved mastery thereof, the model further accounting for a probability that each examinee for each individual test item may achieve mastery of all the attributes from the subset of the selected set of attributes required for the individual test item but fail to apply at least one required and mastered attribute correctly to the individual test item thereby responding to the test item incorrectly and that each examinee for each individual test item may have failed to achieve mastery of at least one required specified attribute for the item and nevertheless apply each required specified attribute for which mastery was not achieved correctly to the item and also applying the remaining required and mastered attributes from the selected set of attributes correctly to the item thereby responding to the test item correctly, and the model expressing for pairs of the set of selected attributes a positive association between the two members of each of the pairs and further expressing a size measure of the positive association of each pair of attributes that can be estimated for each pair from the examinee responses to individual test items; and

applying test results obtained from responses of the examinees to calibrate the individual test items of the model and to generate a prediction of attribute mastery, a prediction of failure to achieve mastery, or a withholding of any prediction for each individual examinee and individual specified attribute combination.

4. A method in accordance with Claim 3 comprising:

constructing a test comprising test items, $X_{ij}=0$ or 1 according as Examinee j gets Item i wrong or right respectively, and selecting a set of attributes $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Examinee j has failed to master or has mastered Attribute k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the test items depend on the selected set of attributes according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of applying all the required attributes correctly as determined by examinee mastery and nonmastery of these required attributes, the product of r^*'s in S_{ij} over the m attributes required for Item i as specified by an item/attribute incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$ Prob(Attribute k applied correctly to item i given that the examinee has not mastered Attribute k), $\pi_{ik} =$ Prob (Attribute k applied correctly to Item i given that the examinee has mastered Attribute k), expressing the size measure of the positive association of each pair of attributes indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal attribute precursors α'_k, $\alpha'_{k'}$ to dichotomous attributes α_k, $\alpha_{k'}$, the needed dichotomous attribute pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a cutpoint.

5. A method comprising:

constructing a test comprising test items and selecting a set of attributes designed to measure proficiency of examinees taking the test and that each examinee has or has not achieved mastery thereof;

creating a mathematically expressed model comprising the test items and the selected attributes, the selected attributes being a subset of a larger group of attributes influencing examinee test item performance with an unspecified remainder of the larger group of attributes being accounted for in the model by a residual ability parameter, the model including parameters describing how the test items depend on the selected set of attributes and how the test items also depend on the residual ability parameter in such a manner that examinee responses to test items provide estimation information about each

69

parameter permitting calibration thereof and provide predictions of which attributes the examinees have or have not achieved mastery thereof, the model further accounting for a probability that each examinee for each individual test item may achieve mastery of all the attributes from the subset of the selected set of attributes required for the individual test item but fail to apply at least one required and mastered attribute correctly to the individual test item thereby responding to the test item incorrectly and that each examinee for each individual test item may have failed to achieve mastery of at least one required specified attribute for the item and nevertheless apply each required specified attribute for which mastery was not achieved correctly to the item and also applying the remaining required and mastered attributes from the selected set of attributes correctly to the item thereby responding to the test item correctly, and the model defining mastery of each attribute to be an assigned level representing that an examinee exceeding the level has acquired attribute competence thereof; and

applying test results obtained from responses of the examinees to calibrate the individual test items of the model and to generate a prediction of attribute mastery, a prediction of failure to achieve mastery, or a withholding of any prediction for each individual examinee and individual specified attribute combination.

6. A method in accordance with Claim 5 comprising:

constructing a test comprising test items, $X_{ij}=0$ or 1 according as Examinee j gets Item i wrong or right respectively, and selecting a set of attributes $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Examinee j has failed to master or has mastered Attribute k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the test items depend on the selected set of attributes according to the following probability:

$$S_{ij}= (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times ... \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of applying all the required attributes correctly as determined by examinee mastery and nonmastery of these required attributes, the product of r^*'s in S_{ij} over the m attributes required for Item i as specified by an item/attribute incidence matrix, $\pi_i^* = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik}= r_{ik}/\pi_{ik}$, with $r_{ik} =$

Prob(Attribute k applied correctly to item i given that the examinee has not mastered Attribute k), π_{ik} = Prob (Attribute k applied correctly to Item i given that the examinee has mastered Attribute k), with p_k being a user determined proportion of examinees judged to have mastered Attribute k.

7. A method comprising:

constructing a test comprising test items and selecting a set of attributes designed to measure proficiency of examinees taking the test and that each examinee has or has not achieved mastery thereof;

creating a mathematically expressed model comprising the test items and the selected attributes, the selected attributes being a subset of a larger group of attributes influencing examinee test item performance with an unspecified remainder of the larger group of attributes being accounted for in the model by a residual ability parameter, the model including parameters describing how the test items depend on the selected set of attributes and how the test items also depend on the residual ability parameter and provide predictions of which attributes the examinees have or have not achieved mastery thereof, the model further accounting for a probability that each examinee for each individual test item may achieve mastery of all the attributes from the subset of the selected set of attributes required for the individual test item but fail to apply at least one required and mastered attribute correctly to the individual test item thereby responding to the test item incorrectly and that each examinee for each individual test item may have failed to achieve mastery of at least one required specified attribute for the item and nevertheless apply each required specified attribute for which mastery was not achieved correctly to the item and also applying the remaining required and mastered attributes from the selected set of attributes correctly to the item thereby responding to the test item correctly, the model defining mastery of each attribute to be an assigned level representing that an examinee exceeding the level has acquired attribute competence thereof, and the model expressing for pairs of the set of selected attributes a positive association between the two members of each of the pairs and further expressing a size

71

measure of the positive association of each pair of attributes that can be estimated for each pair from the examinee responses to individual test items; and

applying test results obtained from responses of the examinees to calibrate the individual test items of the model and to generate a prediction of attribute mastery, a prediction of failure to achieve mastery, or a withholding of any prediction for each individual examinee and individual specified attribute combination.

8. A method in accordance with Claim 7 comprising:

constructing a test comprising test items, $X_{ij}=0$ or 1 according as Examinee j gets Item i wrong or right respectively, and selecting a set of attributes $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Examinee j has failed to master or has mastered Attribute k, respectively; and

creating a mathematically expressed model that includes parameters $\{\underline{\pi}^*, r^*\}$ describing how the test items depend on the selected set of attributes according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of applying all the required attributes correctly as determined by examinee mastery and nonmastery of these required attributes, the product of r^*'s in S_{ij} over the m attributes required for Item i as specified by an item/attribute incidence matrix, $\pi_i^* = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$ Prob(Attribute k applied correctly to item i given that the examinee has not mastered Attribute k), $\pi_{ik} =$ Prob (Attribute k applied correctly to Item i given that the examinee has mastered Attribute k), expressing the size measure of the positive association of each pair of attributes indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal attribute precursors α'_k, $\alpha'_{k'}$ to dichotomous attributes α_k, $\alpha_{k'}$, the needed dichotomous attribute pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a specified mastery level cutpoint such that the Attribute k mastery probability p_k that ($\alpha_k=1$) is defined to equal Prob($\alpha'_k \geq$ cut point) with the level of attribute mastery thus defined by selecting the cut point for α'_k with p_k being the user determined proportion of examinees judged to have mastered Attribute k, thereby each attribute through the continuous α'_k and

72

its cut point having an assigned level representing that an examinee exceeding that level has acquired attribute mastery thereof.

9. A method comprising:

constructing a test comprising test items and selecting a set of attributes designed to measure proficiency of examinees taking the test and that each examinee has or has not achieved mastery thereof;

creating a mathematically expressed model comprising the test items and the selected attributes, the selected attributes being a subset of a larger group of attributes influencing examinee test item performance with an unspecified remainder of the larger group of attributes being accounted for in the model by a residual ability parameter, the model including parameters describing how the test items depend on the selected set of attributes and how the test items also depend on the residual ability parameter in such a manner that examinee responses to test items provide estimation information about each parameter permitting calibration thereof and provide predictions of which attributes the examinees have or have not achieved mastery thereof, the model further accounting for a probability that each examinee for each individual test item may achieve mastery of all the attributes from the subset of the selected set of attributes required for the individual test item but fail to apply at least one required and mastered attribute correctly to the individual test item thereby responding to the test item incorrectly and that each examinee for each individual test item may have failed to achieve mastery of at least one required specified attribute for the item and nevertheless apply each required specified attribute for which mastery was not achieved correctly to the item and also applying the remaining required and mastered attributes from the selected set of attributes correctly to the item thereby responding to the test item correctly; applying test results obtained from responses of the examinees to calibrate the individual test items of the model and to generate a prediction of attribute mastery, a prediction of failure to achieve mastery, or a withholding of any prediction for each individual examinee and individual specified attribute combination.

73

10. A method in accordance with Claim 9 comprising:

constructing a test comprising test items, $X_{ij}=0$ or 1 according as Examinee j gets Item i wrong or right respectively, and selecting a set of attributes $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Examinee j has failed to master or has mastered Attribute k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the test items depend on the selected set of attributes according to the following probability:

$$S_{ij} = (\pi_i{}^*) \times (r_{i1}{}^*)^{1-\alpha j1} \times (r_{i2}{}^*)^{1-\alpha j2} \times ... \times (r_{im}{}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of applying all the required attributes correctly as determined by examinee mastery and nonmastery of these required attributes, the product of r^*'s in S_{ij} over the m attributes required for Item i as specified by an item/attribute incidence matrix, $\pi^*{}_i = \Pi(\pi_{ik})$ with the product over k, $r^*{}_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$ Prob(Attribute k applied correctly to item i given that the examinee has not mastered Attribute k), $\pi_{ik} =$ Prob (Attribute k applied correctly to Item i given that the examinee has mastered Attribute k).

11. A method comprising:

constructing a test comprising test items and selecting a set of attributes designed to measure proficiency of examinees taking the test and that each examinee has or has not achieved mastery thereof;

creating a mathematically expressed model comprising the test items and the selected attributes, the selected attributes being a subset of a larger group of attributes influencing examinee test item performance with an unspecified remainder of the larger group of attributes being accounted for in the model by a residual ability parameter, the model including parameters describing how the test items depend on the selected set of attributes and how the test items also depend on the residual ability parameter and provide predictions of which attributes the examinees have or have not achieved mastery thereof, the model further accounting for a probability that each examinee for each individual test item may achieve mastery of all the attributes from the subset of the selected set of attributes required for the individual test item but fail to apply at least one

74

required and mastered attribute correctly to the individual test item thereby responding to the test item incorrectly and that each examinee for each individual test item may have failed to achieve mastery of at least one required specified attribute for the item and nevertheless apply each required specified attribute for which mastery was not achieved correctly to the item and also applying the remaining required and mastered attributes from the selected set of attributes correctly to the item thereby responding to the test item correctly, and the model defining mastery of each attribute to be an assigned level representing that an examinee exceeding the level has acquired attribute competence thereof; and

applying test results obtained from responses of the examinees to calibrate the individual test items of the model and to generate a prediction of attribute mastery, a prediction of failure to achieve mastery, or a withholding of any prediction for each individual examinee and individual specified attribute combination.

12. A method in accordance with Claim 11 comprising:

constructing a test comprising test items, X_{ij}=0 or 1 according as Examinee j gets Item i wrong or right respectively, and selecting a set of attributes $\{\alpha_{jk}\}$ with α_{jk}=0 or 1 according as Examinee j has failed to master or has mastered Attribute k, respectively; and

creating a mathematically expressed model that includes parameters $\{\underline{\pi}^*, r^*\}$ describing how the test items depend on the selected set of attributes according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times ... \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of applying all the required attributes correctly as determined by examinee mastery and nonmastery of these required attributes, the product of r^*'s in S_{ij} over the m attributes required for Item i as specified by an item/attribute incidence matrix, $\pi_i^* = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with r_{ik} = Prob(Attribute k applied correctly to item i given that the examinee has not mastered Attribute k), π_{ik} = Prob (Attribute k applied correctly to Item i given that the examinee has mastered Attribute k), with p_k being a user determined proportion of examinees judged to have mastered Attribute k.

13. A method comprising:

constructing a test comprising test items and selecting a set of attributes designed to measure proficiency of examinees taking the test and that each examinee has or has not achieved mastery thereof;

creating a mathematically expressed model comprising the test items and the selected attributes, the selected attributes being a subset of a larger group of attributes influencing examinee test item performance with an unspecified remainder of the larger group of attributes being accounted for in the model by a residual ability parameter, the model including parameters describing how the test items depend on the selected set of attributes and how the test items also depend on the residual ability and provide predictions of which attributes the examinees have or have not achieved mastery thereof, the model further accounting for a probability that each examinee for each individual test item may achieve mastery of all the attributes from the subset of the selected set of attributes required for the individual test item but fail to apply at least one required and mastered attribute correctly to the individual test item thereby responding to the test item incorrectly and that each examinee for each individual test item may have failed to achieve mastery of at least one required specified attribute for the item and nevertheless apply each required specified attribute for which mastery was not achieved correctly to the item and also applying the remaining required and mastered attributes from the selected set of attributes correctly to the item thereby responding to the test item correctly, and the model expressing for pairs of the set of selected attributes a positive association between the two members of each of the pairs and further expressing a size measure of the positive association of each pair of attributes that can be estimated for each pair from the examinee responses to individual test items;

applying test results obtained from responses of the examinees to calibrate the individual test items of the model and to generate a prediction of attribute mastery, a prediction of failure to achieve mastery, or a withholding of any prediction for each individual examinee and individual specified attribute combination.

76

14. A method in accordance with Claim 13 comprising:

constructing a test comprising test items, X_{ij}=0 or 1 according as Examinee j gets Item i wrong or right respectively, and selecting a set of attributes $\{\alpha_{jk}\}$ with α_{jk}=0 or 1 according as Examinee j has failed to master or has mastered Attribute k, respectively; and

creating a mathematically expressed model that parameters $\{\underline{\pi}^*, r^*\}$ describing how the test items depend on the selected set of attributes according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of applying all the required attributes correctly as determined by examinee mastery and nonmastery of these required attributes, the product of r^*'s in S_{ij} over the m attributes required for Item i as specified by an item/attribute incidence matrix, $\pi_i^* = \Pi(\pi_{ik})$ with the product over k, $r_{ik}^* = r_{ik}/\pi_{ik}$, with r_{ik} = Prob(Attribute k applied correctly to item i given that the examinee has not mastered Attribute k), π_{ik} = Prob (Attribute k applied correctly to Item i given that the examinee has mastered Attribute k), expressing the size measure of the positive association of each pair of attributes indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal attribute precursors α'_k, $\alpha'_{k'}$ to dichotomous attributes α_k, $\alpha_{k'}$, the needed dichotomous attribute pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a specified cutpoint.

15. A method comprising

constructing a set of medically or psychiatrically focused dichotomizable patient symptoms or dichotomizable personal characteristics, and selecting for evaluation a specified set of possible medical or psychiatric disorders that each patient has or does not have, with multiple disorders per patient being possible;

creating a mathematically expressed model comprising the symptoms or characteristics and the specified disorders selected for evaluation, with a latent health or quality of life parameter representing latent aspects of the patient not included in the specified set of disorders, the model including parameters describing how the symptoms or characteristics depend on the specified set of disorders and how the symptoms or

77

characteristics also depend on a latent general health or quality of life parameter in such a manner that the patient symptoms or characteristics provide estimation information about each parameter permitting calibration thereof and predictions of the likelihood of the possible disorders, the model further accounting for a probability that a patient may possess a set of symptoms or characteristics representative of a disorder and yet the patient does not have the disorder and a patient may lack at least one of the symptoms or characteristics typical of the disorder and yet the patient has the disorder, for some psychiatric and medical disorders the model defining a level judged as constituting having the disorder for each of the some psychiatric and medical disorders, and the model expressing for some pairs among all pairs of the selected set of disorders an association, either positive or negative, of each of the same pairs and further expressing a size measure of the association of each pair of the selected set of disorders that can be estimated from the patient responses to the symptoms or characteristics; and using the model to which patient data is applied to generate predictions of probabilities of patients having each of the disorders in the specified set of possible disorders.

16. A method in accordance with Claim 15 comprising:

constructing a medical or psychiatric diagnosis comprising observed symptoms/characteristics, $X_{ij}=0$ or 1 according as Patient j does not or does display Symptom/characteristic i respectively, and selecting a set of possible disorders $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Patient j does or does not have Disorder k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the symptoms/characteristics depend on the selected set of disorders according to the following probability:

$$S_{ij}= (\pi_i^*) \times (r_{i1}^*)^{1-\alpha_{j1}} \times (r_{i2}^*)^{1-\alpha_{j2}} \times \ldots \times (r_{im}^*)^{1-\alpha_{jm}}$$

with S_{ij} being the probability of displaying Symptom/characteristic i as determined by the disorders Patient j has and does not have and assuming completeness with respect to the latent health/quality of life variable, the product of r*'s over the m disorders associated with Symptom/characteristic i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the

product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with

r_{ik} = Prob(Symptom/characteristic i given that the patient has Disorder k),

π_{ik} = Prob (Symptom/characteristic i given the patient does not have Disorder k),

expressing the size measure of the association of each pair of disorders indirectly as

determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal disorder

precursors α'_k, $\alpha'_{k'}$ to dichotomous disorders α_k, $\alpha_{k'}$, the needed dichotomous disorder

pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a specified disorder cutpoint such that

the Disorder k possession probability p_k is defined to equal Prob($\alpha'_k \geq$ cut point) with

the level α'_k of the disorder judged to constitute having the disorder ($\alpha_k = 0$) thus defined

by selecting the cut point for α'_k with p_k being the proportion of the patients judged to

have the disorder as determined by the setting of the α'_k cutpoint, thereby each disorder

through the continuous α'_k and its cut point having an assigned level representing that a

patient exceeding that level has the disorder.

17. A method comprising

constructing a set of medically or psychiatrically focused dichotomizable

patient symptoms or dichotomizable personal characteristics, and selecting for evaluation

a specified set of possible medical or psychiatric disorders that each patient has or does

not have, with multiple disorders per patient being possible;

creating a mathematically expressed model comprising the symptoms or

characteristics and the specified disorders selected for evaluation, with a latent health or

quality-of-life parameter representing latent aspects of the patient not included in the

specified set of disorders, the model including parameters describing how the symptoms

or characteristics depend on the specified set of disorders and how the symptoms or

characteristics also depend on a latent general health or quality of life parameter in such

a manner that the patient symptoms or characteristics provide estimation information

about each parameter permitting calibration thereof and predictions of the likelihood of

the possible disorders, the model further accounting for a probability that a patient may

possess a set of symptoms or characteristics representative of a disorder and yet the

patient does have the disorder and a patient may lack at least one of the symptoms or

characteristics typical of the disorder and yet the patient has the disorder and the model

79

expressing for some pairs among all pairs of the selected set of disorders an association, either positive or negative, of each of the same pairs and further expressing a size measure of the association of each pair of the selected set of disorders that can be estimated from the patient responses to the symptoms or characteristics; and using the model to which patient data is applied to generate predictions of probabilities of patients having each of the disorders in the specified set of possible disorders.

18. A method in accordance with Claim 17 comprising:

constructing a medical or psychiatric diagnosis comprising observed symptoms/characteristics, $X_{ij}=0$ or 1 according as Patient j does not or does display Symptom/characteristic i respectively, and selecting a set of possible disorders $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Patient j does or does not have Disorder k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the symptoms/characteristics depend on the selected set of disorders according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of displaying Symptom/characteristic i as determined by the disorders Patient j has and does not have and assuming completeness with respect to the latent health/quality of life variable, the product of r^*'s over the m disorders associated with Symptom/characteristic i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with

r_{ik} = Prob(Symptom/characteristic i given that the patient has Disorder k),

π_{ik} = Prob (Symptom/characteristic i given the patient does not have Disorder k),

expressing the size measure of the association of each pair of disorders indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal disorder

precursors α'_k, $\alpha'_{k'}$ to dichotomous disorders α_k, $\alpha_{k'}$, the needed dichotomous disorder pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a cutpoint.

19. A method comprising

constructing a set of medically or psychiatrically focused dichotomizable patient symptoms or dichotomizable personal characteristics, and selecting for evaluation a specified set of possible medical or psychiatric disorders that each patient has or does not have, with multiple disorders per patient being possible;

creating a mathematically expressed model comprising the symptoms or characteristics and the specified disorders selected for evaluation, with a latent health or quality-of-life parameter representing latent aspects of the patient not included in the specified set of disorders, the model including parameters describing how the symptoms or characteristics depend on the specified set of disorders and how the symptoms or characteristics also depend on a latent general health or quality of life parameter in such a manner that the patient symptoms or characteristics provide estimation information about each parameter permitting calibration thereof and predictions of the likelihood of the possible disorders, the model further accounting for a probability that a patient may possess a set of symptoms or characteristics representative of a disorder and yet the patient does not have the disorder and a patient may lack at least one of the symptoms or characteristics typical of the disorder and yet the patient has the disorder, for some psychiatric and medical disorders the model defining a level judged as constituting having the disorder for each of the some psychiatric and medical disorders; and

using the model to which patient data is applied to generate predictions of probabilities of patients having each of the disorders in the specified set of possible disorders.

20. A method in accordance with Claim 19 comprising:

constructing a medical or psychiatric diagnosis comprising observed symptoms/characteristics, $X_{ij}=0$ or 1 according as Patient j does not or does display Symptom/characteristic i respectively, and selecting a set of possible disorders $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Patient j does or does not have Disorder k, respectively; and

81

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the symptoms/characteristics depend on the selected set of disorders according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of displaying Symptom/characteristic i as determined by the disorders Patient j has and does not have and assuming completeness with respect to the latent health/quality of life variable, the product of r^*'s over the m disorders associated with Symptom/characteristic i as specified by the incidence matrix, $\pi_i^* = \Pi(\pi_{ik})$ with the product over k, $r_{ik}^* = r_{ik}/\pi_{ik}$, with

r_{ik} = Prob(Symptom/characteristic i given that the patient has Disorder k),

π_{ik} = Prob (Symptom/characteristic i given the patient does not have Disorder k), with p_k being the proportion of the patients judged to have the disorder as determined by the user defining the disorder.

21. A method comprising

constructing a set of medically or psychiatrically focused dichotomizable patient symptoms or dichotomizable personal characteristics, and selecting for evaluation a specified set of possible medical or psychiatric disorders that each patient has or does not have, with multiple disorders per patient being possible;

creating a mathematically expressed model comprising the symptoms or characteristics and the specified disorders selected for evaluation, with a latent health or quality-of-life parameter representing latent aspects of the patient not included in the specified set of disorders, the model including parameters describing how the symptoms or characteristics depend on the specified set of disorders and how the symptoms or characteristics also depend on a latent general health or quality of life parameter, the model further accounting for a probability that a patient may possess a set of symptoms or characteristics typical of a disorder and yet the patient does not have the disorder and a patient may lack at least one of the symptoms or characteristics representative of the disorder and yet the patient has the disorder, for some psychiatric and medical disorders the model defining a level judged as constituting having the disorder for each of the some

psychiatric and medical disorders, and the model expressing for some pairs among all pairs of the selected set of disorders an association, either positive or negative, of each of the pairs and further expressing a size measure of the association of each pair of the selected set of disorders that can be estimated from the patient responses to the symptoms or characteristics; and

using the model to which patient data is applied to generate predictions of probabilities of patients having each of the disorders in the specified set of possible disorders.

22. A method in accordance with Claim 21 comprising:

constructing a medical or psychiatric diagnosis comprising observed symptoms/characteristics, $X_{ij}=0$ or 1 according as Patient j does not or does display Symptom/characteristic i respectively, and selecting a set of possible disorders $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Patient j does or does not have Disorder k, respectively; and

creating a mathematically expressed model that includes parameters $\{\pi^*, r^*\}$ describing how the symptoms/characteristics depend on the selected set of disorders according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j 1} \times (r_{i2}^*)^{1-\alpha j 2} \times \ldots \times (r_{im}^*)^{1-\alpha j m}$$

with S_{ij} being the probability of displaying Symptom/characteristic i as determined by the disorders Patient j has and does not have and assuming completeness with respect to the latent health/quality of life variable, the product of r^*'s over the m disorders associated with Symptom/characteristic i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with

r_{ik} = Prob(Symptom/characteristic i given that the patient has Disorder k),

π_{ik} = Prob (Symptom/characteristic i given the patient does not have Disorder k), expressing the size measure of the association of each pair of disorders indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal disorder precursors α'_k, $\alpha'_{k'}$ to dichotomous disorders α_k, $\alpha_{k'}$, the needed dichotomous disorder pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a specified disorder cutpoint such that the Disorder k possession probability p_k is defined to equal Prob($\alpha'_k \geq$ cut point) with

the level α'_k of the disorder judged to constitute having the disorder ($\alpha_k=0$) thus defined by selecting the cut point for α'_k with p_k being the proportion of the patients judged to have the disorder as determined by the setting of the α'_k cutpoint, thereby each disorder through the continuous α'_k and its cut point having an assigned level representing that a patient exceeding that level has the disorder.

23. A method comprising

constructing a set of medically or psychiatrically focused dichotomizable patient symptoms or dichotomizable personal characteristics, and selecting for evaluation a specified set of possible medical or psychiatric disorders that each patient has or does not have, with multiple disorders per patient being possible;

creating a mathematically expressed model comprising the symptoms or characteristics and the specified disorders selected for evaluation, with a latent health or quality-of-life parameter representing latent aspects of the patient not included in the specified set of disorders, the model including parameters describing how the symptoms or characteristics depend on the specified set of disorders and how the symptoms or characteristics also depend on a latent general health or quality of life parameter in such a manner that the patient symptoms or characteristics provide estimation information about each parameter permitting calibration thereof and predictions of the likelihood of the possible disorders, the model further accounting for a probability that a patient may possess a set of symptoms or characteristics representative of a disorder and yet the patient does not have the disorder and a patient may lack at least one of the symptoms or characteristics typical of the disorder and yet the patient has the disorder; and

using the model to which patient data is applied to generate predictions of probabilities of patients having each of the disorders in the specified set of possible disorders.

24. A method in accordance with Claim 23 comprising:

constructing a medical or psychiatric diagnosis comprising observed symptoms/characteristics, $X_{ij}=0$ or 1 according as Patient j does not or does display Symptom/characteristic i respectively, and selecting a set of possible disorders $\{\alpha_{jk}\}$ with

84

α_{jk}=0 or 1 according as Patient j does or does not have Disorder k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the symptoms/characteristics depend on the selected set of disorders according to the following probability:

$$S_{ij} = (\pi_i{}^*) \times (r_{i1}{}^*)^{1-\alpha j1} \times (r_{i2}{}^*)^{1-\alpha j2} \times \ldots \times (r_{im}{}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of displaying Symptom/characteristic i as determined by the disorders Patient j has and does not have and assuming completeness with respect to the latent health/quality of life variable, the product of r^*'s over the m disorders associated with Symptom/characteristic i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with

r_{ik} = Prob(Symptom/characteristic i given that the patient has Disorder k),

π_{ik} = Prob (Symptom/characteristic i given the patient does not have Disorder k).

25. A method comprising

constructing a set of medically or psychiatrically focused dichotomizable patient symptoms or dichotomizable personal characteristics, and selecting for evaluation a specified set of possible medical or psychiatric disorders that each patient has or does not have, with multiple disorders per patient being possible;

creating a mathematically expressed model comprising the symptoms or characteristics and the specified disorders selected for evaluation, with a latent health or quality-of-life parameter representing latent aspects of the patient not included in the specified set of disorders, the model including parameters describing how the symptoms or characteristics depend on the specified set of disorders and how the symptoms or characteristics also depend on a latent general health or quality of life parameter , the model further accounting for a probability that a patient may possess a set of symptoms or characteristics representative of a disorder and yet the patient does not have the disorder and a patient may lack at least one of the symptoms or characteristics typical of the disorder and yet the patient has the disorder, for some psychiatric and medical disorders the model defining a level judged as constituting having the disorder for each of

85

the some psychiatric and medical disorders, and

using the model to which patient data is applied to generate predictions of probabilities of patients having each of the disorders in the specified set of possible disorders.

26. A method in accordance with Claim 25 comprising:

constructing a medical or psychiatric diagnosis comprising observed symptoms/characteristics, $X_{ij}=0$ or 1 according as Patient j does not or does display Symptom/characteristic i respectively, and selecting a set of possible disorders $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Patient j does or does not have Disorder k, respectively; and

creating a mathematically expressed model that includes parameters $\{\underline{\pi}^*, r^*\}$ describing how the symptoms/characteristics depend on the selected set of disorders according to the following probability:

$$S_{ij}= (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of displaying Symptom/characteristic i as determined by the disorders Patient j has and does not have and assuming completeness with respect to the latent health/quality of life variable, the product of r^*'s over the m disorders associated with Symptom/characteristic i as specified by the incidence matrix, $\pi_i^* = \Pi(\pi_{ik})$ with the product over k, $r_{ik}^*= r_{ik}/\pi_{ik}$, with

r_{ik} = Prob(Symptom/characteristic i given that the patient has Disorder k),

π_{ik} = Prob (Symptom/characteristic i given the patient does not have Disorder k), with p_k being the proportion of the patients judged to have the disorder as determined by the user defining of the disorder.

27. A method comprising

constructing a set of medically or psychiatrically focused dichotomizable patient symptoms or dichotomizable personal characteristics, and selecting for evaluation a specified set of possible medical or psychiatric disorders that each patient has or does not have, with multiple disorders per patient being possible;

creating a mathematically expressed model comprising the symptoms or

86

characteristics and the specified disorders selected for evaluation, with a latent health or quality-of-life parameter representing latent aspects of the patient not included in the specified set of disorders, the model including parameters describing how the symptoms or characteristics depend on the specified set of disorders and how the symptoms or characteristics also depend on a latent general health or quality of life , the model further accounting for a probability that a patient may possess a set of symptoms or characteristics representative of a disorder and yet the patient does not have the disorder and a patient may lack at least one of the symptoms or characteristics typical of the disorder and yet the patient has the disorder and the model expressing for some pairs among all pairs of the selected set of disorders an association, either positive or negative, of each of the same pairs and further expressing a size measure of the association of each pair of the selected set of disorders that can be estimated from the patient responses to the symptoms or characteristics; and

using the model to which patient data is applied to generate predictions of probabilities of patients having each of the disorders in the specified set of possible disorders.

28. A method in accordance with Claim 27 comprising:

constructing a medical or psychiatric diagnosis comprising observed symptoms/characteristics, $X_{ij}=0$ or 1 according as Patient j does not or does display Symptom/characteristic i respectively, and selecting a set of possible disorders $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Patient j does or does not have Disorder k, respectively; and

creating a mathematically expressed model that includes parameters $\{\underline{\pi}^*, r^*\}$ describing how the symptoms/characteristics depend on the selected set of disorders according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha_{j1}} \times (r_{i2}^*)^{1-\alpha_{j2}} \times \ldots \times (r_{im}^*)^{1-\alpha_{jm}}$$

with S_{ij} being the probability of displaying Symptom/characteristic i as determined by the disorders Patient j has and does not have and assuming completeness with respect to the latent health/quality of life variable, the product of r^*'s over the m disorders associated

87

with Symptom/characteristic i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with

r_{ik} = Prob(Symptom/characteristic i given that the patient has Disorder k),

π_{ik} = Prob (Symptom/characteristic i given the patient does not have Disorder k), expressing the size measure of the association of each pair of disorders indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal disorder precursors α'_k, $\alpha'_{k'}$ to dichotomous disorders α_k, $\alpha_{k'}$, the needed dichotomous disorder pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a cutpoint.

29. A method comprising:

constructing a set of dichotomizably scored probes and selecting a set of unobservable dichotomized properties possessed or not possessed by each object and the intent to assess a latent state of each of the objects being probed;

creating a mathematically expressed model comprising the probes and the selected properties, the selected properties being a subset of a larger group of properties influencing probe response of objects with an unspecified remainder of the larger group of properties being accounted for in the model by a residual state parameter, the model including parameters describing how the probes depend on the selected set of properties and how the probes also depend on the residual state parameter in such a manner that object responses to the probes provide estimation information about each parameter permitting calibration thereof and predictions of which properties the objects do or do not possess, the model further accounting for a probability that an object for each individual probe may possess all the properties from the subset of the selected set of properties required for a positive response to the individual probe but may fail to apply at least one required property appropriately to the individual probe, thereby responding to the probe negatively, and that each object for each individual probe may have failed to possess at least one specified property required for a positive response to the probe and nevertheless apply appropriately the required specified properties that are not possessed to the probe and also apply the remaining required and possessed properties from the selected set of properties appropriately, thereby responding to the probe positively, the model defining the level of possession of each property to be an assigned level judged to

88

confer object possession of the individual property, and the model expressing for pairs of the selected set of properties an association , either positive or negative, between the two members of each of the pairs and further expressing a size measure of the positive or negative association of each pair of properties that can be estimated for each pair from the object responses to the individual probes;

applying combined probe results obtained from the responses of the objects to calibrating the individual probes of the model; and

generating a prediction of possession of the property, a prediction of failure to possess the property, or a withholding of such a prediction for each object and specified property combination.

30. A method in accordance with Claim 29 comprising:

constructing a set of dichotomously scored probes, $X_{ij}=0$ or 1 according as Object j responds negatively or positively to Probe i respectively, and selecting a set of latent properties $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Object j does not possess or possesses Property k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the probes depend on the selected set of latent properties according to the following probability:

$$S_{ij}= (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times ... \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of responding positively to Probe i as determined by the specified properties Object j possesses and does not possess and assuming completeness with respect to the residual state, the product of r^*'s over the m properties required for a positive response to Probe i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik}= r_{ik}/\pi_{ik}$, with $r_{ik} =$
Prob(positive response to Probe i given that the object does not possess Property k), πik = Prob (positive response to Probe i given that the object does possess Property k), expressing the size measure of the positive association of each pair of properties indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal property precursors α'_k, $\alpha'_{k'}$ to dichotomous properties α_k, $\alpha_{k'}$, the needed dichotomous property pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at a specified possession level

cutpoint such that the Property k possession probability p_k that (α_k=1) is defined to equal Prob($\alpha'_k \geq$ cut point) with the level of property possession thus defined by selecting the cut point for α'_k with p_k being the user decided proportion of objects judged to possess Property k, thereby each property through the continuous α'_k and its cut point having an assigned level representing that an object exceeding that level possesses the property.

31. A method comprising:

constructing a set of dichotomizably scored probes and selecting a set of unobservable dichotomized properties possessed or not possessed by each object and the intent to assess a latent state of each of the objects being probed;

creating a mathematically expressed model comprising the probes and the selected properties, the selected properties being a subset of a larger group of properties influencing probe responses of objects with an unspecified remainder of the larger group of properties being accounted for in the model by a residual state parameter, the model including parameters describing how the probes depend on the selected set of properties and how the probes also depend on the residual state parameter in such a manner that object responses to the probes provide estimation information about each parameter permitting calibration thereof and predictions of which properties the objects do or do not possess, the model further accounting for a probability that an object for each individual probe may possess all the properties from the subset of the selected set of properties required for a positive response to the individual probe but may fail to apply at least one required property appropriately to the individual probe, thereby responding to the probe negatively, and that each object for each individual probe may have failed to possess at least one selected property required for a positive response to the probe and nevertheless apply appropriately the required selected properties that are not possessed to the probe and also apply the unspecified remaining properties from the selected set of properties appropriately, thereby responding to the probe positively, and the model expressing for pairs of the selected set of properties an association , either positive or negative, between the two members of each of the pairs and further expressing a size measure of the positive or negative association of each pair of properties that can be estimated for each pair from the object responses to the individual probes;

applying combined probe results obtained from the responses of the objects to calibrating the individual probes of the model; and

generating a prediction of possession of the property, a prediction of failure to possess the property, or a withholding of such a prediction for each object and specified property combination.

32. A method in accordance with Claim 31 comprising:

constructing a set of dichotomously scored probes, X_{ij}=0 or 1 according as Object j responds negatively or positively to Probe i respectively, and selecting a set of latent properties $\{\alpha_{jk}\}$ with α_{jk}=0 or 1 according as Object j does not possess or possesses Property k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the probes depend on the selected set of latent properties according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha_{j1}} \times (r_{i2}^*)^{1-\alpha_{j2}} \times ... \times (r_{im}^*)^{1-\alpha_{jm}}$$

with S_{ij} being the probability of responding positively to Probe i as determined by the specified properties Object j possesses and does not possess and assuming completeness with respect to the residual state, the product of r^*'s over the m properties required for a positive response to Probe i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$

Prob(positive response to Probe i given that the object does not possess Property k),

π_{ik} = Prob (positive response to Probe i given that the object does possess Property k), expressing the size measure of the positive association of each pair of properties indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal property precursors α'_k, $\alpha'_{k'}$ to dichotomous properties α_k, $\alpha_{k'}$, the needed dichotomous property pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at some level.

33. A method comprising:

constructing a set of dichotomizably scored probes and selecting a set of unobservable dichotomized properties possessed or not possessed by each object and the intent to assess a latent state of each of the objects being probed;

creating a mathematically expressed model comprising the probes and the selected properties, the selected properties being a subset of a larger group of properties influencing probe responses of objects with an unspecified remainder of the larger group of properties being accounted for in the model by a residual state parameter, the model including parameters describing how the probes depend on the selected set of properties and how the probes also depend on the residual state parameter in such a manner that object responses to the probes provide estimation information about each parameter permitting calibration thereof and predictions of which properties the objects do or do not possess, the model further accounting for a probability that an object for each individual probe may possess all the properties from the subset of the selected set of properties required for a positive response to the individual probe but may fail to apply at least one required property appropriately to the individual probe , thereby responding to the probe negatively, and that each object for each individual probe may have failed to possess at least one selected property required for a positive response to the probe and nevertheless apply appropriately the required selected properties that are not possessed to the probe and also apply the unspecified remaining properties from the selected set of properties appropriately, thereby responding to the probe positively, the model defining the level of possession of each property to be an assigned level judged to confer object possession of the individual property;

applying combined probe results obtained from the responses of the objects to calibrating the individual probes of the model; and

generating a prediction of possession of the property, a prediction of failure to possess the property, or a withholding of such a prediction for each object and specified property combination.

34. A method in accordance with Claim 33 comprising:

constructing a set of dichotomously scored probes, $X_{ij}=0$ or 1 according as Object j responds negatively or positively to Probe i respectively, and selecting a set of latent properties $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Object j does not possess or possesses Property k, respectively; and

creating a mathematically expressed model that includes identifiable and

92

hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the probes depend

on the selected set of latent properties according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of responding positively to Probe i as determined by the

specified properties Object j possesses and does not possess and assuming completeness

with respect to the residual state, the product of r^*'s over the m properties required for a

positive response to Probe i as specified by the incidence matrix, $\pi_i^* = \Pi(\pi_{ik})$ with the

product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$

Prob(positive response to Probe i given that the object does not possess Property k), π_{ik}

= Prob (positive response to Probe i given that the object does possess Property k), with

p_k being the user decided proportion of objects judged to possess Property k.

    35. A method comprising:

        constructing a set of dichotomizably scored probes and selecting a set

of unobservable dichotomized properties possessed or not possessed by each object and

designed to assess a latent state of each of the objects being probed;

        creating a mathematically expressed model comprising the probes and the

selected properties, the selected properties being a subset of a larger group of properties

influencing probe responses of objects with an unspecified remainder of the larger group

of properties being accounted for in the model by a residual state parameter, the model

including parameters describing how the probes depend on the selected set of properties

and how the probes also depend on the residual state parameter and predictions of which

properties the objects do or do not possess, the model further accounting for a

probability that an object for each individual probe may possess all the properties from

the subset of the selected set of properties required for a positive response to the

individual probe but may fail to apply at least one required property appropriately to the

individual probe, thereby responding to the probe negatively, and that each object for

each individual probe may have failed to possess at least one selected property required

for a positive response to the probe and nevertheless apply appropriately the required

selected properties that are not possessed to the probe and also apply the unspecified

remaining properties from the selected set of properties appropriately, thereby responding

to the probe positively, the model defining the level of possession of each property to be an assigned level judged to confer object possession of the individual property, and the model expressing for pairs of the selected set of properties an association , either positive or negative, between the two members of each of the pairs and further expressing a size measure of the positive or negative association of each pair of properties that can be estimated for each pair from the object responses to the individual probes;

applying combined probe results obtained from the responses of the objects to calibrating the individual probes of the model; and

generating a prediction of possession of the property, a prediction of failure to possess the property, or a withholding of such a prediction for each object and specified property combination.

36. A method in accordance with Claim 35 comprising:

constructing a set of dichotomously scored probes, X_{ij}=0 or 1 according as Object j responds negatively or positively to Probe i respectively, and selecting a set of latent properties $\{\alpha_{jk}\}$ with α_{jk}=0 or 1 according as Object j does not possess or possesses Property k, respectively; and

creating a mathematically expressed model that includes parameters $\{\underline{\pi}^*$, $r^*\}$ describing how the probes depend on the selected set of latent properties according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times ... \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of responding positively to Probe i as determined by the specified properties Object j possesses and does not possess and assuming completeness with respect to the residual state, the product of r*'s over the m properties required for a positive response to Probe i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$

Prob(positive response to Probe i given that the object does not possess Property k),

π_{ik} = Prob (positive response to Probe i given that the object does possess Property k), expressing the size measure of the positive association of each pair of properties indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal property precursors α'_k, $\alpha'_{k'}$ to dichotomous properties α_k, $\alpha_{k'}$, the needed dichotomous

94

property pairs α_k, α_k, then produced by cutting each α'_k at a specified possession level cutpoint such that the Property k possession probability p_k that ($\alpha_k=1$) is defined to equal Prob($\alpha'_k \geq$ cut point) with the level of property possession thus defined by selecting the cut point for α'_k with p_k being the user decided proportion of objects judged to possess Property k, thereby each property through the continuous α'_k and its cut point having an assigned level representing that an object exceeding that level possesses the property.

37. A method comprising:

constructing a set of dichotomizably scored probes and selecting a set of unobservable dichotomized properties possessed or not possessed by each object and the intent to assess a latent state of each of the objects being probed;

creating a mathematically expressed model comprising the probes and the selected properties, the selected properties being a subset of a larger group of properties influencing probe responses of objects with an unspecified remainder of the larger group of properties being accounted for in the model by a residual state parameter, the model including parameters describing how the probes depend on the selected set of properties and how the probes also depend on the residual state parameter in such a manner that object responses to the probes provide estimation information about each parameter permitting calibration thereof and predictions of which properties the objects do or do not possess, the model further accounting for a probability that an object for each individual probe may possess all the properties from the subset of the selected set of properties required for a positive response to the individual probe but may fail to apply at least one required property appropriately to the individual probe, thereby responding to the probe negatively, and that each object for each individual probe may have failed to possess at least one selected property required for a positive response to the probe and nevertheless apply appropriately the required selected properties that are not possessed to the probe and also apply the unspecified remaining properties from the selected set of properties appropriately, thereby responding to the probe positively;

applying combined probe results obtained from the responses of the objects to calibrating the individual probes of the model; and

generating a prediction of possession of the property, a prediction of

95

failure to possess the property, or a withholding of such a prediction for each object and specified property combination.

38. A method in accordance with Claim 37 comprising:

constructing a set of dichotomously scored probes, $X_{ij}=0$ or 1 according as Object j responds negatively or positively to Probe i respectively, and selecting a set of latent properties $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Object j does not possess or possesses Property k, respectively; and

creating a mathematically expressed model that includes identifiable and hence capable of being calibrated parameters $\{\underline{\pi}^*, r^*\}$ describing how the probes depend on the selected set of latent properties according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times \ldots \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of responding positively to Probe i as determined by the specified properties Object j possesses and does not possess and assuming completeness with respect to the residual state, the product of r^*'s over the m properties required for a positive response to Probe i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$ Prob(positive response to Probe i given that the object does not possess Property k), π_{ik} = Prob (positive response to Probe i given that the object does possess Property k).

39. A method comprising:

constructing a set of dichotomizably scored probes and selecting a set of unobservable dichotomized properties possessed or not possessed by each object and the intent to assess a latent state of each of the objects being probed;

creating a mathematically expressed model comprising the probes and the selected properties, the selected properties being a subset of a larger group of properties influencing probe responses of objects with an unspecified remainder of the larger group of properties being accounted for in the model by a residual state parameter, the model including parameters describing how the probes depend on the selected set of properties and how the probes also depend on the residual state parameter and predictions of which properties the objects do or do not possess, the model further accounting for a

probability that an object for each individual probe may possess all the properties from the subset of the selected set of properties required for a positive response to the individual probe but may fail to apply at least one required property appropriately to the individual probe, thereby responding to the probe negatively, and that each object for each individual probe may have failed to possess at least one selected property required for a positive response to the probe and nevertheless apply appropriately the required selected properties that are not possessed to the probe and also apply the unspecified remaining properties from the selected set of properties appropriately, thereby responding to the probe positively, the model defining the level of possession of each property to be an assigned level judged to confer object possession of the individual property;

applying combined probe results obtained from the responses of the objects to calibrating the individual probes of the model; and

generating a prediction of possession of the property, a prediction of failure to possess the property, or a withholding of such a prediction for each object and specified property combination.

40. A method in accordance with Claim 39 comprising:

constructing a set of dichotomously scored probes, $X_{ij}=0$ or 1 according as Object j responds negatively or positively to Probe i respectively, and selecting a set of latent properties $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Object j does not possess or possesses Property k, respectively; and

creating a mathematically expressed model that includes parameters $\{\underline{\pi}^*, r^*\}$ describing how the probes depend on the selected set of latent properties according to the following probability:

$$S_{ij} = (\pi_i^*) \times (r_{i1}^*)^{1-\alpha_{j1}} \times (r_{i2}^*)^{1-\alpha_{j2}} \times \ldots \times (r_{im}^*)^{1-\alpha_{jm}}$$

with S_{ij} being the probability of responding positively to Probe i as determined by the specified properties Object j possesses and does not possess and assuming completeness with respect to the residual state, the product of r*'s over the m properties required for a positive response to Probe i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik} = r_{ik}/\pi_{ik}$, with $r_{ik} =$

Prob(positive response to Probe i given that the object does not possess Property k), π_{ik} = Prob (positive response to Probe i given that the object does possess Property k), with p_k being the user decided proportion of objects judged to possess Property k.

41. A method comprising:

constructing a set of dichotomizably scored probes and selecting a set of unobservable dichotomized properties possessed or not possessed by each object and the intent to assess a latent state of each of the objects being probed;

creating a mathematically expressed model comprising the probes and the selected properties, the selected properties being a subset of a larger group of properties influencing probe responses of objects with an unspecified remainder of the larger group of properties being accounted for in the model by a residual state parameter, the model including parameters describing how the probes depend on the selected set of properties and how the probes also depend on the residual state parameter and predictions of which properties the objects do or do not possess, the model further accounting for a probability that an object for each individual probe may possess all the properties from the subset of the selected set of properties required for a positive response to the individual probe but may fail to apply at least one required property appropriately to the individual probe, thereby responding to the probe negatively, and that each object for each individual probe may have failed to possess at least one selected property required for a positive response to the probe and nevertheless apply appropriately the required selected properties that are not possessed to the probe and also apply the unspecified remaining properties from the selected set of properties appropriately, thereby responding to the probe positively, and the model expressing for pairs of the selected set of properties an association , either positive or negative, between the two members of each of the pairs and further expressing a size measure of the positive or negative association of each pair of properties that can be estimated for each pair from the object responses to the individual probes;

applying combined probe results obtained from the responses of the objects to calibrating the individual probes of the model; and

generating a prediction of possession of the property, a prediction of

failure to possess the property, or a withholding of such a prediction for each object and specified property combination.

42. A method in accordance with Claim 41 comprising:

constructing a set of dichotomously scored probes, $X_{ij}=0$ or 1 according as Object j responds negatively or positively to Probe i respectively, and selecting a set of latent properties $\{\alpha_{jk}\}$ with $\alpha_{jk}=0$ or 1 according as Object j does not possess or possesses Property k, respectively; and

creating a mathematically expressed model that includes parameters $\{\underline{\pi}^*, r^*\}$ describing how the probes depend on the selected set of latent properties according to the following probability:

$$S_{ij}= (\pi_i^*) \times (r_{i1}^*)^{1-\alpha j1} \times (r_{i2}^*)^{1-\alpha j2} \times ... \times (r_{im}^*)^{1-\alpha jm}$$

with S_{ij} being the probability of responding positively to Probe i as determined by the specified properties Object j possesses and does not possess and assuming completeness with respect to the residual state, the product of r*'s over the m properties required for a positive response to Probe i as specified by the incidence matrix, $\pi^*_i = \Pi(\pi_{ik})$ with the product over k, $r^*_{ik}= r_{ik}/\pi_{ik}$, with $r_{ik} =$ Prob(positive response to Probe i given that the object does not possess Property k), $\pi_{ik} =$ Prob (positive response to Probe i given that the object does possess Property k), expressing the size measure of the positive association of each pair of properties indirectly as determined by the correlation $\sigma_{kk'}$ between continuous bivariate normal property precursors α'_k, $\alpha'_{k'}$ to dichotomous properties α_k, $\alpha_{k'}$, the needed dichotomous property pairs α_k, $\alpha_{k'}$ then produced by cutting each α'_k at some possession level cutpoint.